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PATENT  
Docket No.: M4065.0223/P223

#16/Declaration  
4-23-02  
R. Guale

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of:  
Chih-Chen Cho

Serial No.: 09/517,314 ✓

Group Art Unit: 2811 ✓

Filed: March 2, 2000 ✓

Examiner: D. Kang ✓

For: BACKEND METALLIZATION  
METHOD AND DEVICE  
OBTAINED THEREFROM ✓

Commissioner for Patents  
Washington, D.C. 20231

**DECLARATION OF CHIH-CHEN CHO UNDER 37 CFR 1.131**

Dear Sir:

I, Chih-Chen Cho, declare and state as follows:

1. I reside at 1993 Wood Duck Lane, Boise, Idaho 83706.
2. I am the sole inventor of the above-identified U.S. patent application (the “’314 application”) filed on March 2, 2000, as evidenced by the attached executed Declaration document filed with the United States Patent and Trademark Office on March 2, 2000 (Exhibit A).
3. I have reviewed and understood the ‘314 application, including the currently pending claims and amendments (the “Claimed Invention”).
4. I myself conceived the invention covered by the Claimed Invention prior to January 28, 2000, as evidenced by Exhibit B, which is a copy of Micron Technology Inc. (“Micron”) Invention Disclosure document #99-0506. This document contains a write up

of the conception of my invention which I prepared. The actual dates on this document and any description not relevant to the conception of the Claimed Invention have been blanked out; however, the conception, signature and witness dates are all prior to January 28, 2000. Micron is the assignee of the present application.

5. After the approval for filing of a patent application for the invention described in the Invention Disclosure (Exhibit B) by the Micron Patent Committee, the law firm of Dickstein Shapiro Morin & Oshinsky LPP ("DSMO") was assigned to write this application, as evidenced by attached Exhibit C, which is a copy of an order letter from Micron's Legal Department to DSMO. Although the date of this letter is blanked out, I have reviewed a copy of the letter containing the date and I can confirm that the letter was written prior to January 28, 2000. DSMO began preparation of a draft of the '314 application covering the Claimed Invention, and I had discussions with DSMO attorneys subsequent to the date of this letter, which led to several drafts of the application. Attached as Exhibit D is a copy of a letter written by a DSMO attorney forwarding a final draft of the '314 application covering the Claimed Invention to Micron for my review. Once again, the date of this letter has been removed, but I reviewed a copy of the letter and I can confirm that the letter is dated prior to January 28, 2000.

6. The final draft of the '314 application covering the Claimed Invention was received by me prior to January 28, 2000. After my review of the final draft of the '314 application, the final draft was forwarded to Micron Patent Department, which was also reviewing the final draft of the '314 application, and to Micron corporate representative for execution of a power of attorney. After Micron Patent Department approved the final draft of the '314 application, I executed the application on February 28, 2000, as evidenced by the Declaration (Exhibit A), and the executed final draft of the '314 application was

forwarded again to Micron Patent Department and from there to DSMO. The application was filed with the United States Patent and Trademark Office on March 2, 2000. The preparation and filing of the present application covering the Claimed Invention was diligently pursued from prior to the date of January 28, 2000 to the date of filing, March 2, 2000.

All statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true; and these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the above-identified patent.

Date: 4/10/2002

By: Chih-Chen Cho /

Chih-Chen Cho

APR 11 2002

et No.: M4065.0223/P223  
Micron No. 99-0506

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

DECLARATION FOR PATENT APPLICATION

As the below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

BACKEND METALLIZATION METHOD AND DEVICE OBTAINED THEREFROM

The specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by an amendment, if any, specifically referred to in this oath or declaration.

I acknowledge the duty to disclose all information known to me which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

			Priority Not Claimed
_____ (Number)	_____ (Country)	_____ (Filing Date)	<input type="checkbox"/>
_____ (Number)	_____ (Country)	_____ (Filing Date)	<input type="checkbox"/>
_____ (Number)	_____ (Country)	_____ (Filing Date)	<input type="checkbox"/>

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I hereby claim the benefit under Title 35, United States Code, § 120/365 of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States

application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56(a) which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Please address all correspondence to Thomas J. D'Amico of Dickstein Shapiro Morin & Oshinsky LLP located at 2101 L Street NW

Washington, DC 20037-1526. Telephone calls should be made to (202) 785-9700.

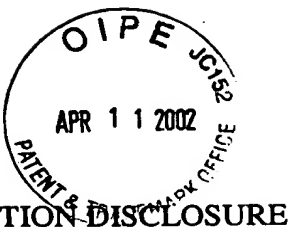
Full name of sole inventor: Chih-Chen Cho

Inventor's signature: Chih-Chen Cho Date: Feb. 28, 2000

Residence: Boise, Idaho

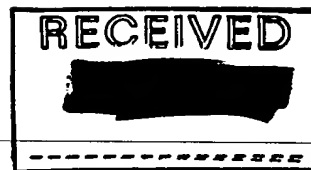
Citizenship: ~~United States of America~~ c.c. Taiwan

Post Office Address: 1993 Wood Duck Lane  
Boise, Idaho 83706



If ARPA project,  
please check below:

INVENTION DISCLOSURE



- ☐ Advanced SRAM
- ☐ BST
- ☐ FED
- ☐ FE RAM
- ☐ NCAICM

99-0506

1. INVENTOR(S): Chih-Chen Cho

## 2. DESCRIPTION

## 2.1 Title of invention:

Formation of Al or Cu Vias with Zero or Negative Overlap

## 2.2 Brief description:

As device feature size continues to shrink, it becomes imperative to use vias without surround (overlap) to save space. When misalignment occurs on vias with zero surround, or when negative overlap is allowed in design rule, via can fall off the landed metal and deep pockets will be formed. The deep pockets prevent barrier metal such as Ti or TiN from being deposited continuously at the bottom of the vias. This results in high resistance via or open via because the barrier metal acts as a seeding layer for subsequent metal like Al to grow, when part of the seeding layer is missing void forms in the vias. Although W via plug is effective in eliminating the problem, it has higher resistance and costs more than Al via.

In this patent disclosure, an etch/CMP stop layer is proposed to prevent the formation of the pockets.

2.3 Also attach a complete description, including drawings or sketches and articles relevant to the invention. Legible photocopies of laboratory notebooks are acceptable.

Figure 1

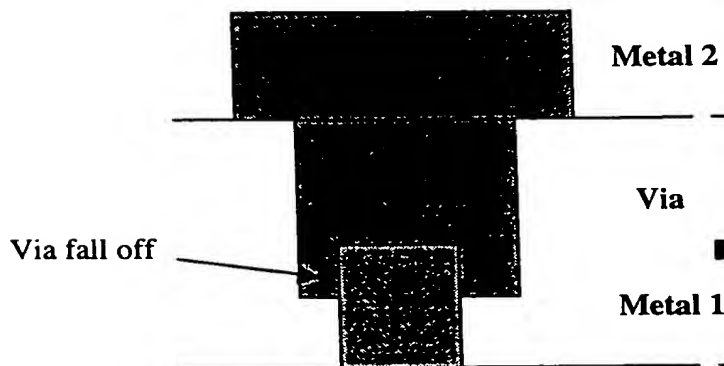
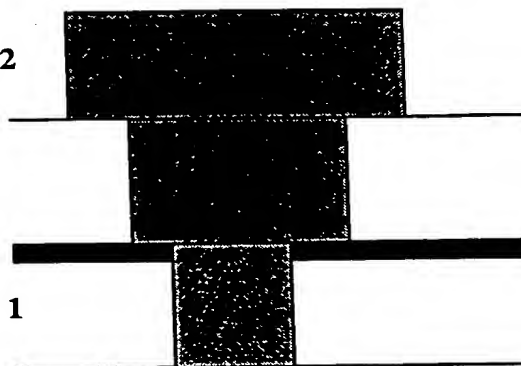


Figure 2



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Figure 1 shows the problem of via fall off. Metal 1 can be formed by subtractive metal etch or by single Damascene process. Via can be formed by conventional ILD via etch or as a part of Dual Damascene process.

Figure 2 shows that a dielectric layer can be used on top of ILD during the metal 1 single Damascene process to act as a stop layer during metal 1 CMP and a stop layer during via etch to prevent the formation of deep pockets. The etch/CMP stop layer should be made of a dielectric that exhibits good etch selectivity verse the ILD material. For example, a silicon nitride stop layer can be used with SiO<sub>2</sub> ILD. Or, a SiO<sub>2</sub> stop layer can be used with low-k ILD.

A typical flow can be:

ILD-1 deposition (for metal 1 single Damascene)

Etch/CMP stop layer deposition

Photo patterning

Etch/Clean

Metal 1 barrier and Metal 1 deposition

Metal 1 CMP

ILD-2 deposition (for via and metal-2 Dual Damascene)

Photo patterning

Etch/Clean

Metal 2 barrier and Metal 2 deposition

Metal 2 CMP

If via-2 and metal-3 are used, the etch/CMP stop layer can be applied following the ILD-2 deposition so that no deep pocket will form during via-2 etch. The same applied to multiple metal layer structure.

Although, there is little data showing whether the via fall off will cause void in Cu via, the same concept can be apply to prevent pocket formation during Cu via etch.

### 3. INFORMATION CONCERNING CONCEPTION OF INVENTION

#### 3.1 CONCEPTION AND DOCUMENTATION OF THE INVENTION

a. Identify the date when you first conceived the invention. (If not sure, give the earliest date of which you are sure.)

[REDACTED]

b. To whom was the idea first described and on what date? (Other than a co-inventor.)

John Zahurak on [REDACTED]

c. Identify the date of the first tangible record such as computer simulation, tape out, drawing or written description. Please specify type and location.





### 3.2 CONCEPTION OF THE INVENTION

a. Please identify related invention disclosures, patents or other publications describing similar ideas, and other companies working in the same field. Attach copies, if available.

None

b. What is the closest technology, of which you are aware?

Thicker metal barrier was used to pinch off the pocket and form a continuous seed layer. But this increases via resistance, because the resistance of barrier material such as Ti or TiN is higher than the metal material such as Al or Cu. Also, Ti reacts with Al to form high resistance TiAlx.

c. Identify the advantages of this invention over previous technology.

This invention allows the formation of a via without deep pockets. The etch/CMP stop layer also helps to improve CMP uniformity and the mechanical strength of the ILD. Using nitride capped ILD may help to reduce intra-metal line leakage. When low-k dielectric is used for ILD, having a cap layer may be inevitable. The etch/CMP stop layer can be served as the cap layer of low-k ILD.

### 3.3 IMPORTANT DATES

a. Has the invention been disclosed outside the company?   No   If yes, to whom, when, and in what form?

b. Have any articles describing your invention been published?   No   If yes, list author(s), title of article, publication and date.

c. Have any engineering samples been given out?   No   If yes, to whom and on what date?

d. Has any product using the invention been sold or offered for sale?   No   If yes, to whom and on what date?

### 3.4 DISPOSITION OF THE INVENTION

a. When will (or did) Micron begin use of the invention experimentally?

To be determined

b. When will (or did) Micron begin production of this invention?

To be determined

### 3.5 MISCELLANEOUS INFORMATION

a. Was the invention developed during a joint development agreement or other contract with an outside company? \_\_\_\_\_

No

b. Please list developmental work outside of the company (including Government proposal or contract).

None

4. INVENTORS:

Name: \_\_\_\_\_ Chih-Chen Cho \_\_\_\_\_

Micron Phone: \_\_\_\_\_ 81479 \_\_\_\_\_  
Company Name(VERY IMPORTANT):

☒ Micron Technology, Inc.  
☐ Micron Electronics, Inc.  
☐ Micron Quantum Devices  
☐ Micron Display Technology, Inc.  
☐ Micron Communications, Inc.  
☐ Other \_\_\_\_\_

Micron Mail Stop: \_\_\_\_\_ 306 \_\_\_\_\_  
Dept. Name: \_\_\_\_\_ Proc. R & D. \_\_\_\_\_  
Dept. #: \_\_\_\_\_ 850G \_\_\_\_\_

Home Address: \_\_\_\_\_ 1993 Wood Duck Ln. \_\_\_\_\_

\_\_\_\_\_ Boise, ID 83706 \_\_\_\_\_

Citizenship: \_\_\_\_\_ Taiwan, China \_\_\_\_\_

Supervisor: \_\_\_\_\_ Chuck Dennison \_\_\_\_\_

Signature: \_\_\_\_\_ Chih-Chen Cho \_\_\_\_\_

Date: \_\_\_\_\_

5. WITNESS

If there is only one inventor, a witness should sign and date this disclosure. A witness in this case is a non-inventor who understands the nature of the invention.

\_\_\_\_\_  
(Signature of Witness)

\_\_\_\_\_  
(Date)

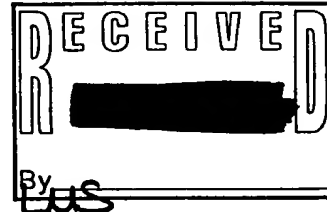
Note: If you have any questions or wish assistance completing this form, please call the Legal/Patent Department, ext. 4527.

# MICRON<sup>®</sup>

TECHNOLOGY, INC.

[REDACTED]

Tom D'Amico  
Dickstein, Sharpiro, Morin,  
& Oshinsky  
2101 L. Street N.W.  
Washington, DC 20037



Re: New Disclosures

Dear Tom:

The following disclosures have been assigned to your docket:

Docket #	Priority	Notes
[REDACTED]	Regular	
[REDACTED]	Regular	
[REDACTED]	Regular	
[REDACTED]	Regular	
[REDACTED]	Regular	
[REDACTED]	Regular	
[REDACTED]	Regular	
[REDACTED]	Regular	
[REDACTED]	Regular	
[REDACTED]	Regular	
[REDACTED]	Regular	
[REDACTED]	Regular	
99-0506	Regular	
[REDACTED]	Regular	
[REDACTED]	Regular	
[REDACTED]	Regular	
[REDACTED]	Regular	
[REDACTED]	Regular	

Please prepare and file a patent application with the U.S. Patent and Trademark Office on behalf of Micron Technology, Inc. for each. Where possible, please draft system, product and process claims for each. If you have any questions regarding these disclosures or any other disclosures, please feel free to call.

Sincerely,



Lisa Boyer  
Patent Assistant

Phone: 208/368-4797

Fax: 208/368-5606

DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP

2101 L Street NW • Washington, DC 20037-1526

Tel (202) 785-9700 • Fax (202) 887-0689

Writer's Direct Dial: (202) 775-4798

E-Mail Address: [PowellW@dsmo.com](mailto:PowellW@dsmo.com)

**VIA FEDERAL EXPRESS**

Mr. Chih-Chen Cho  
c/o Lisa Boyer  
Micron Technology, Inc.  
8000 South Federal Way  
Boise, Idaho 83707-0006

**PRIVILEGED AND CONFIDENTIAL:  
ATTORNEY-CLIENT COMMUNICATION**

U.S. Patent Application  
Title: Backend Metallization Method and Device Obtained Therefrom  
Inventor: Chih-Chen Cho  
Your Ref. No.: 99-0506  
Our Ref. No.: M4065.0223/P223

Dear Mr. Cho:

Enclosed is the final draft of a patent application for your invention entitled "Backend Metallization Method and Device Obtained Therefrom."

Enclosed is a signature copy of the above-referenced application herewith including a Power of Attorney by Assignee for execution by Michael L. Lynch. We have added information to the specification in response to your comments. The Power of Attorney by Assignee requires Mr. Lynch to certify that he has reviewed the signed Assignment from the inventor. Please execute the enclosed documents and return them to us at your earliest convenience. When we receive the executed documents, we will immediately file the application with the U.S. Patent and Trademark Office.

If you have any questions, please do not hesitate to call.

Very truly yours,



William E. Powell III

WEP/dgw  
Enclosures  
cc: Thomas J. D'Amico, Esq.